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Title: Focused Ion Beam analysis of non radioactive samples

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# Focused Ion Beam analysis of non radioactive samples

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Mary Ann Hill	Sigma 2
Daniel Rios	AMPP-4
Juan Duque	C-PCS

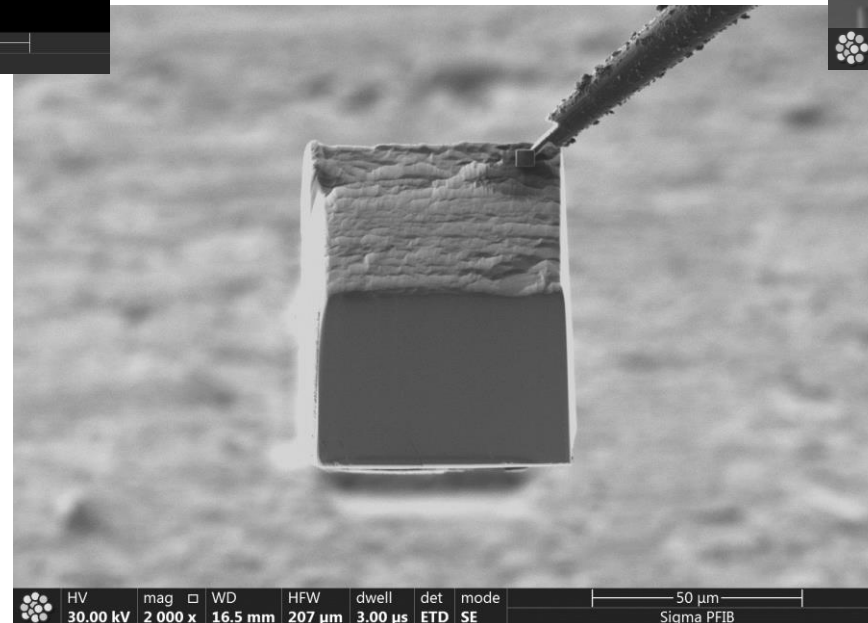
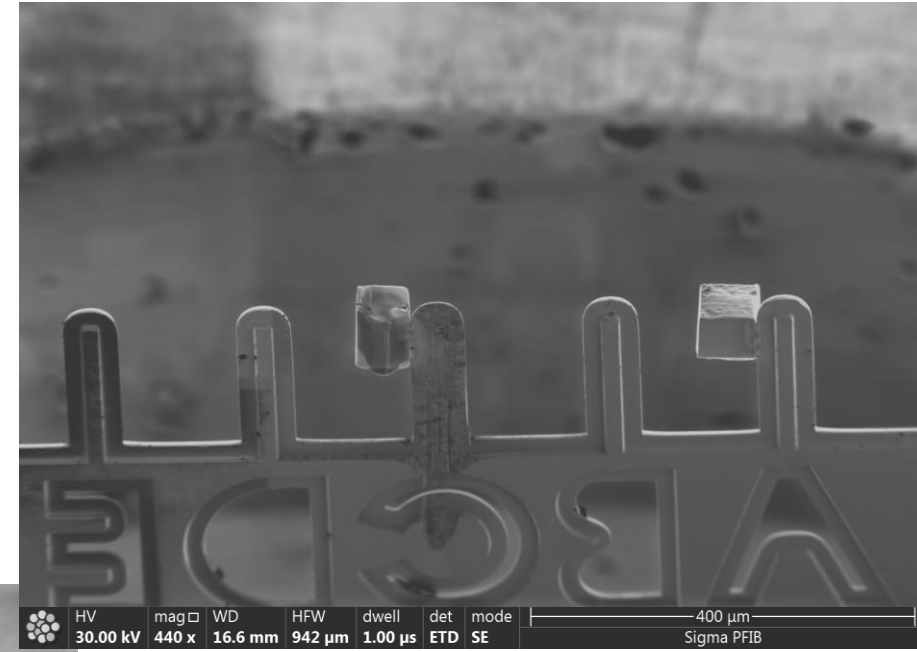
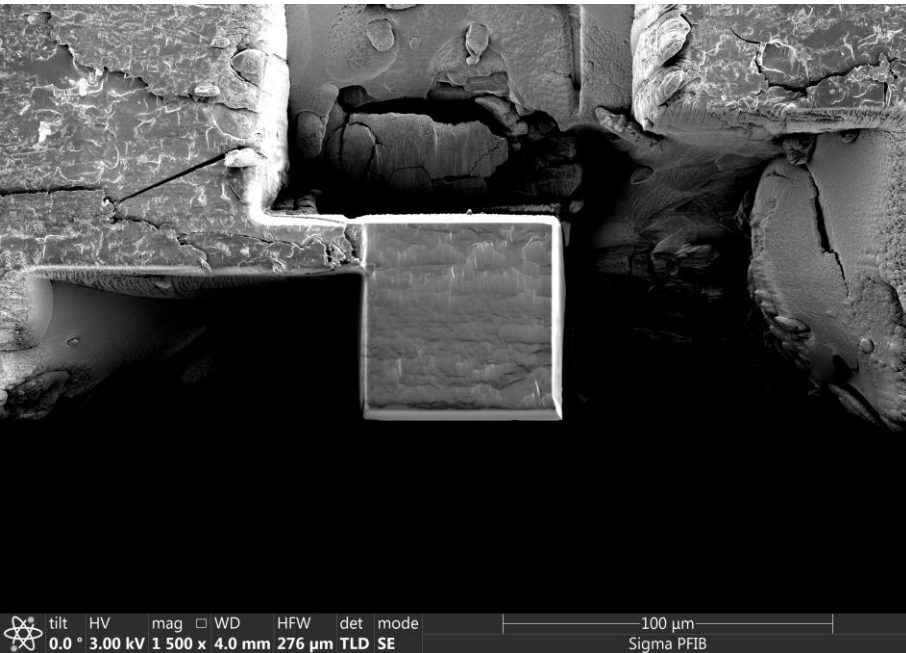


# Helios G4 Plasma FIB

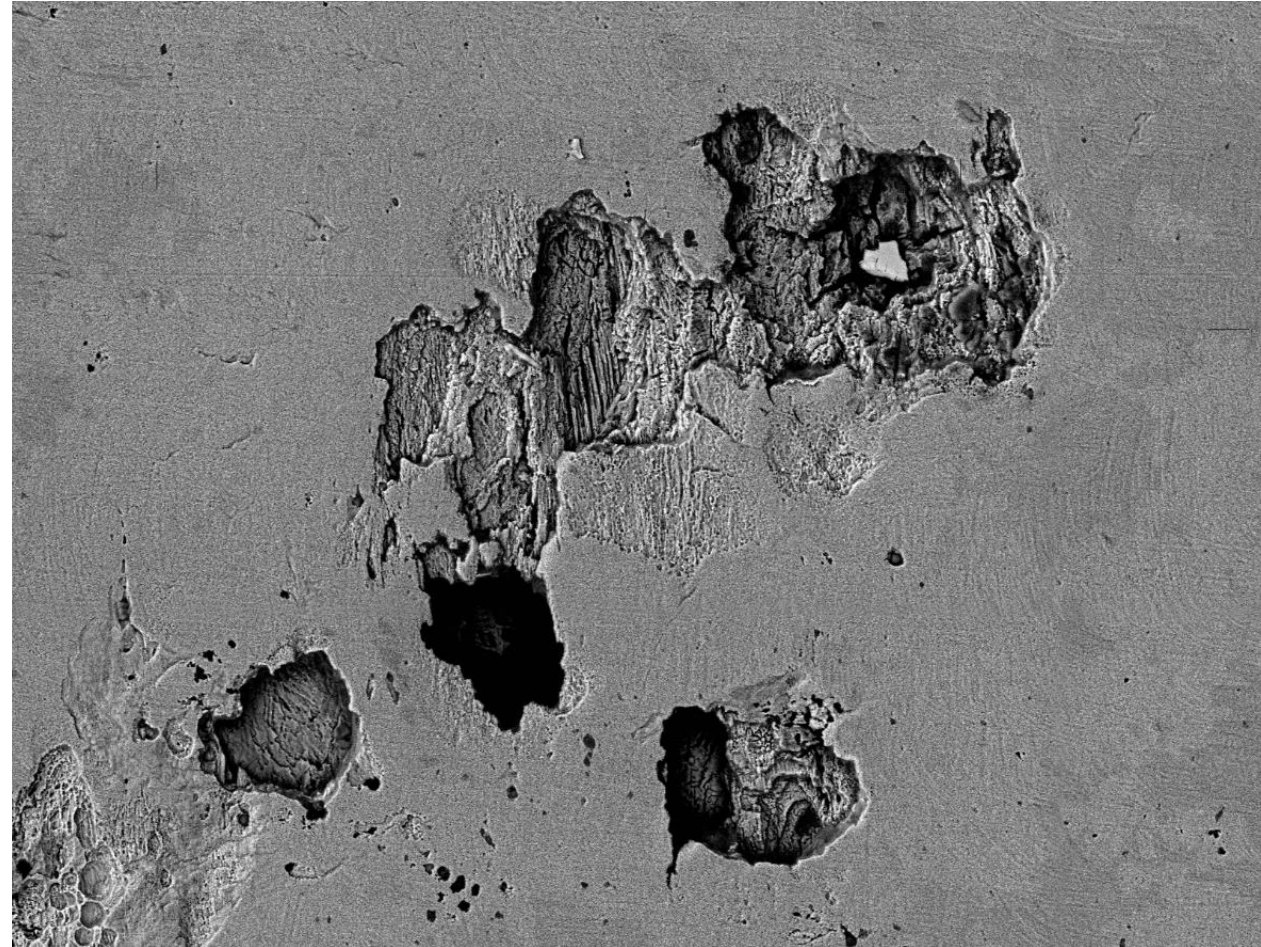
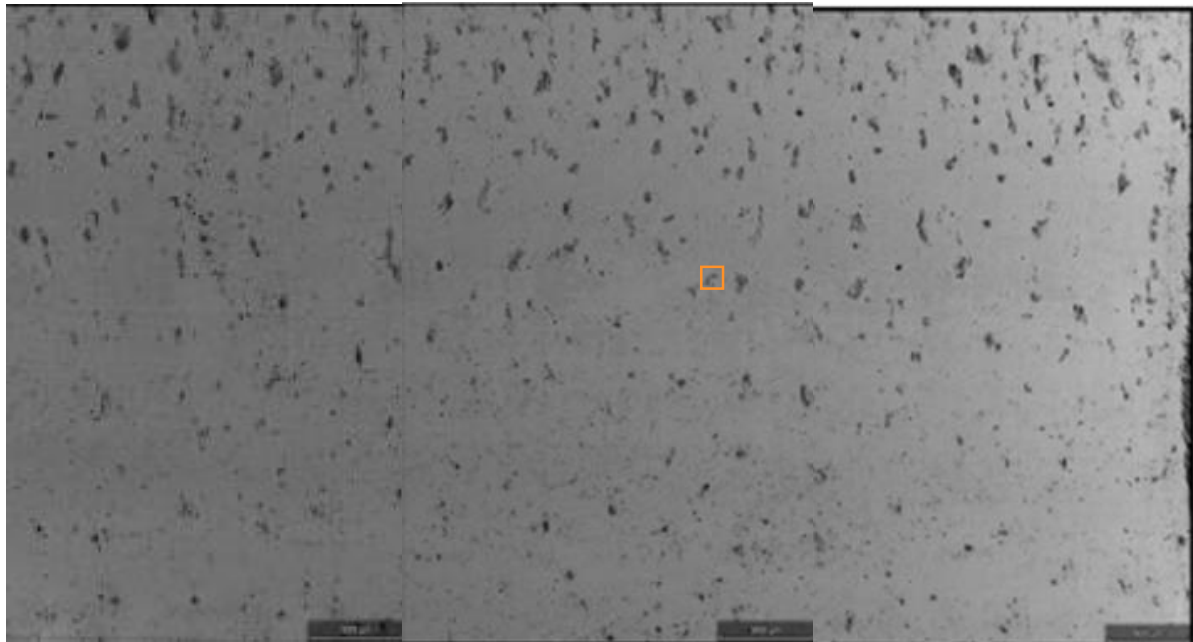
- Xe ion column mills material 30x faster than Ga.
- Options include: Energy Dispersive Spectroscopy (EDS), Wavelength Dispersive spectroscopy (WDS) Electron backscattered Diffraction (EBSD), Time of Flight Sims (ToF SIMS), Inert gas/vacuum sample transfer system.
- Excels at micromachining and collecting 3D datasets using various detection systems.



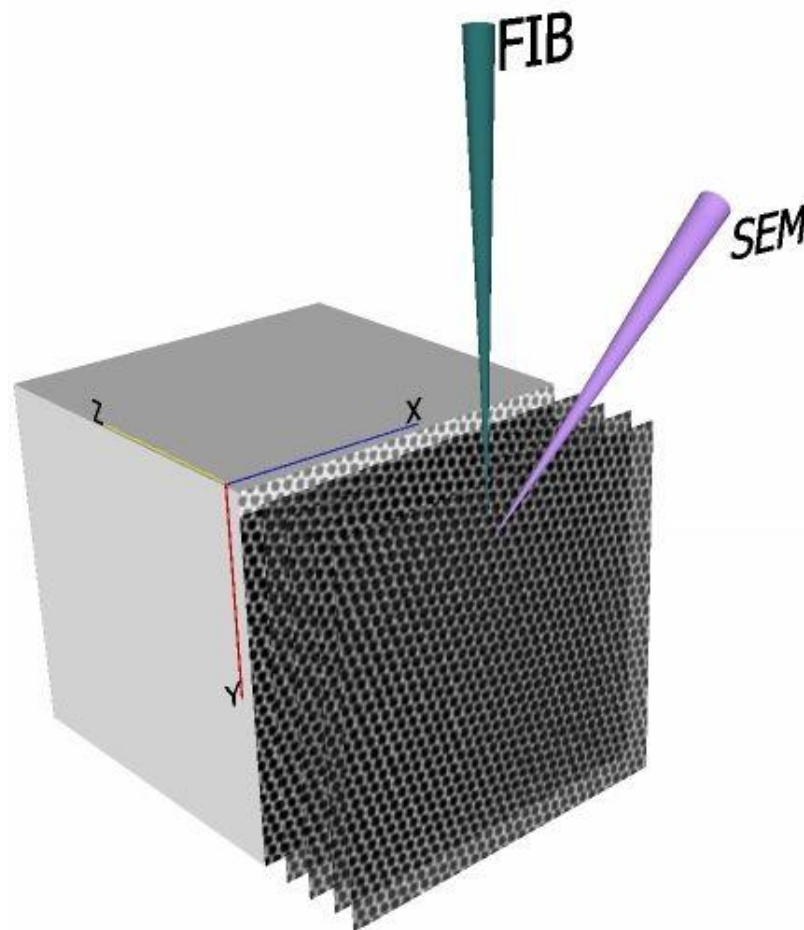
# UO<sub>2</sub> cube extraction by micromachining



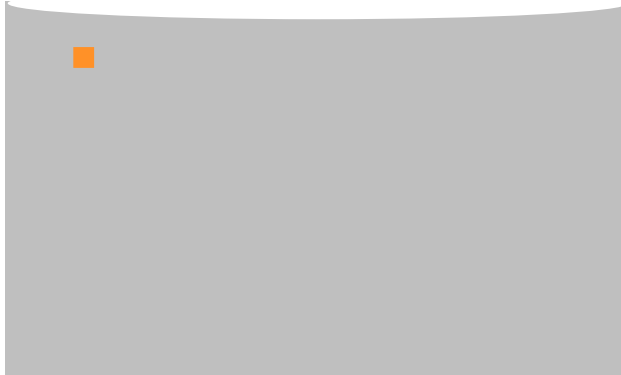
# High resolution electron image montages



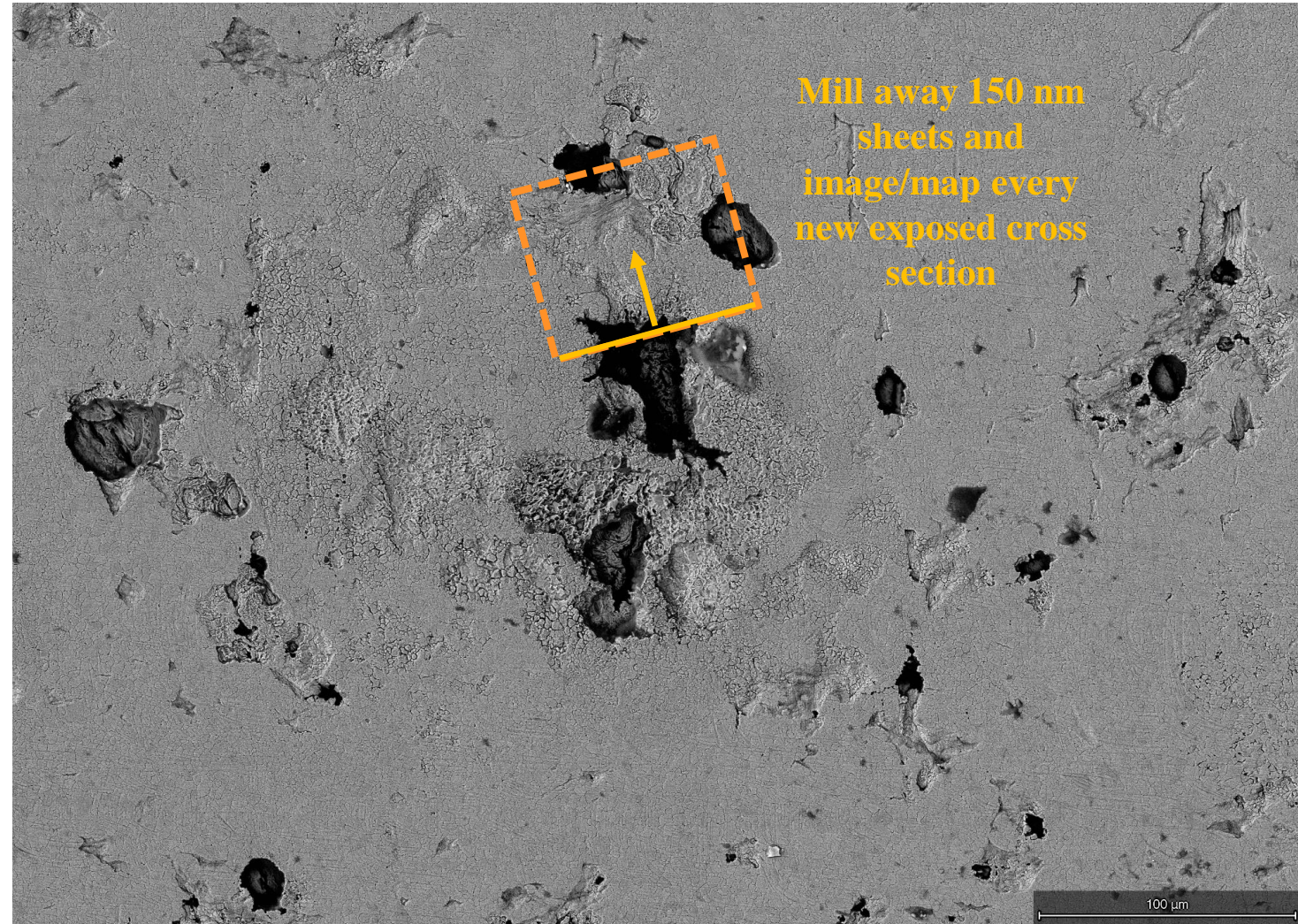
# Standard FIB/SEM Operation for serial sectioning



# Destructive 3D tomography (Secondary Electron Images + EDS) from a 3013 reacted with $\text{Cl}_2$ gas.

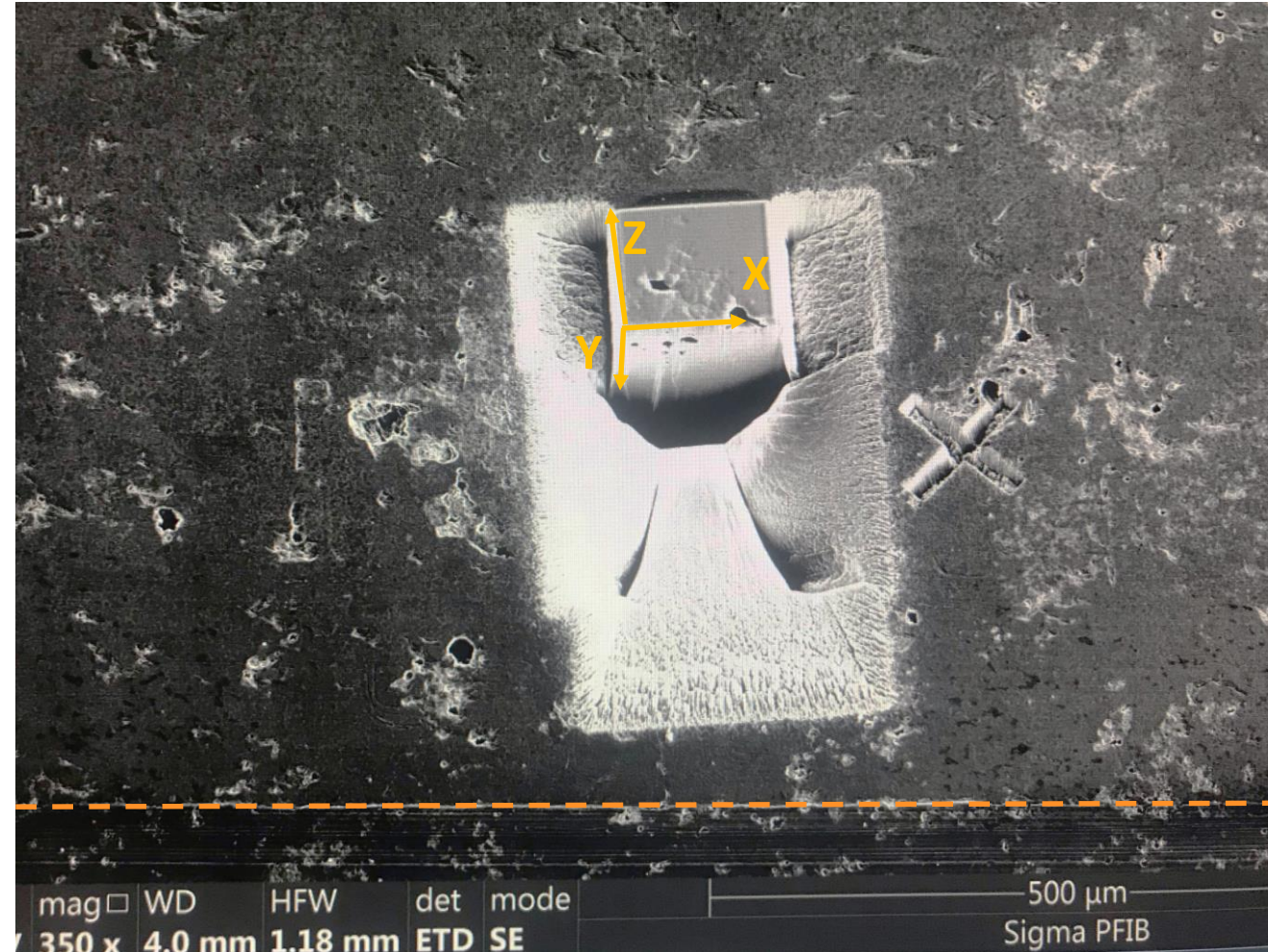
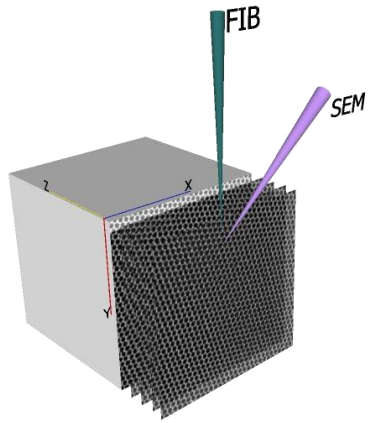


Location on 3013 near wall  
weld. Close to zone 2/3  
boundary.



Region of interest prior to milling. Boundary between zones 2  
and 3 is beyond bottom of image.

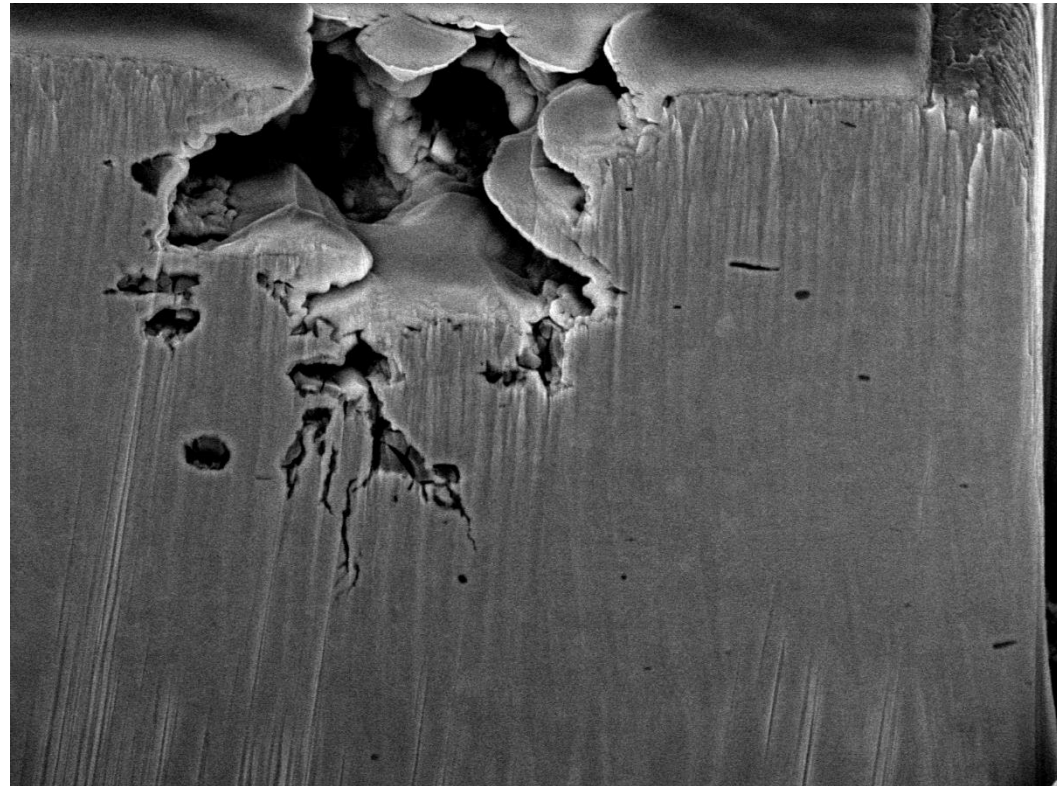
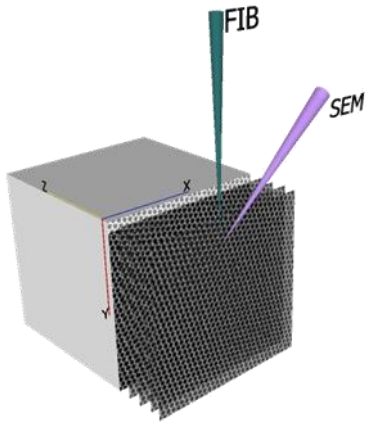
# Volume of interest after PFIB Pre-processing



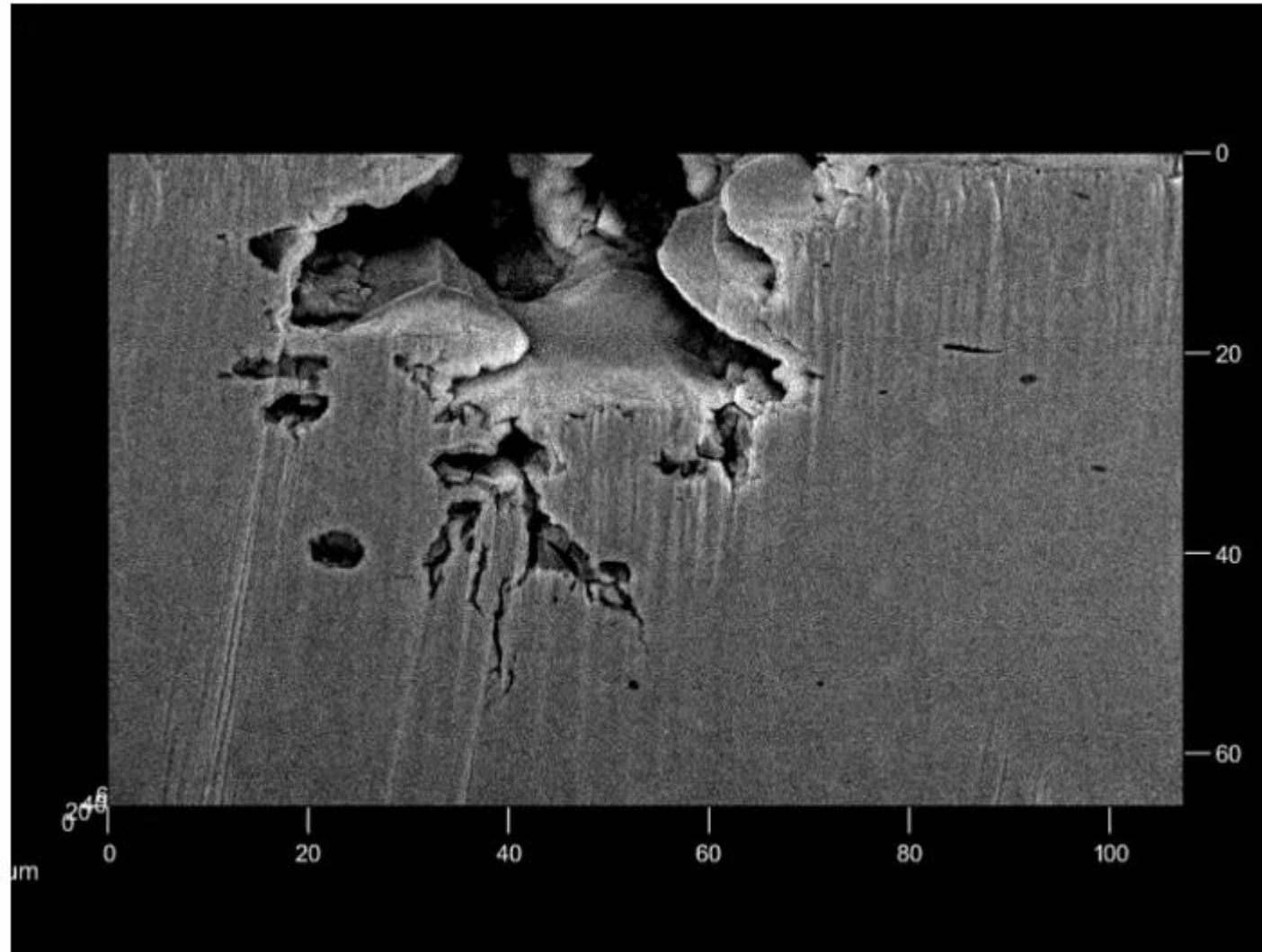
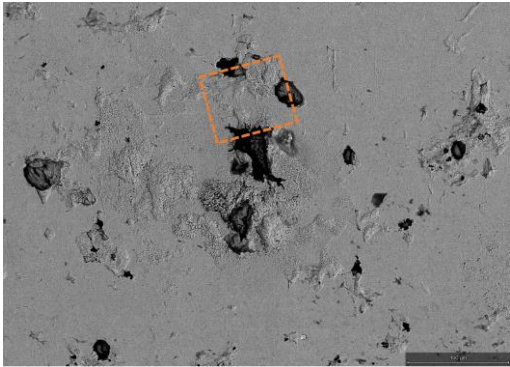
Boundary  
between  
zone 2 and 3



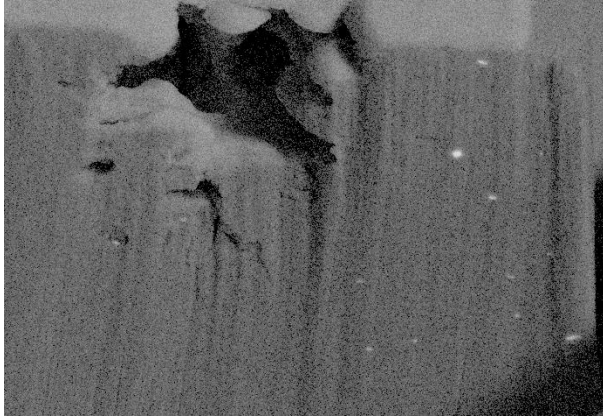
First cross section of volume of interest  
as seen by electron column.



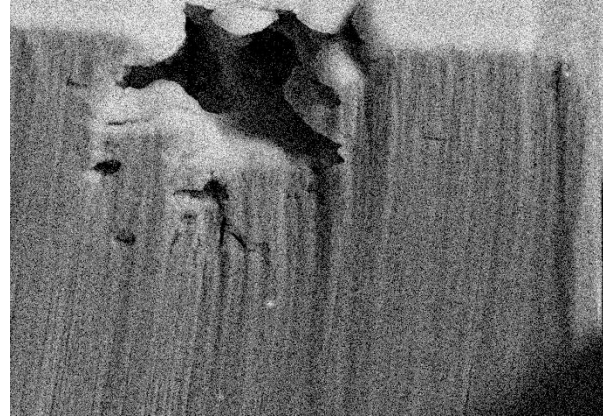
# Secondary electron image stack (produced every slice (150 nm))



# Spectral maps (produced every slice (150 nm))



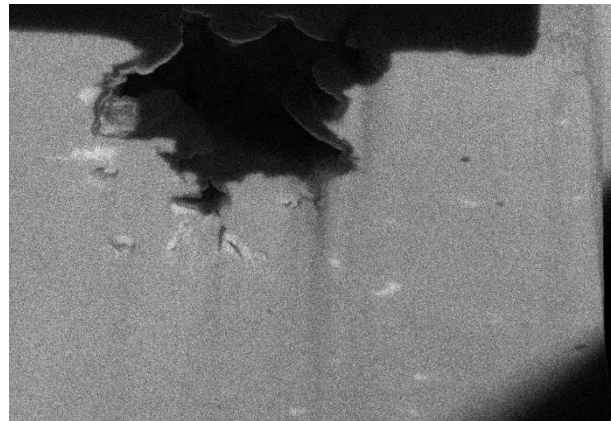
S



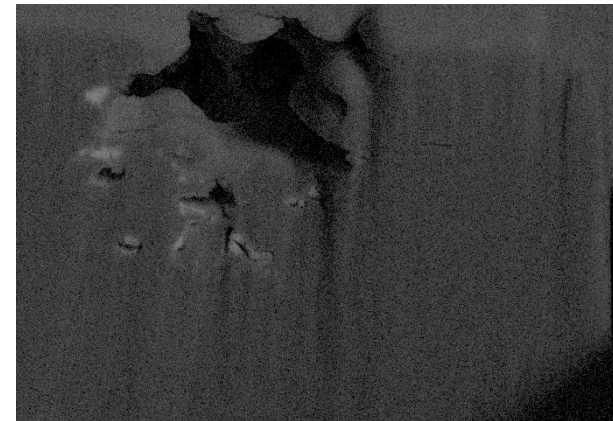
Si



Mn



Cr



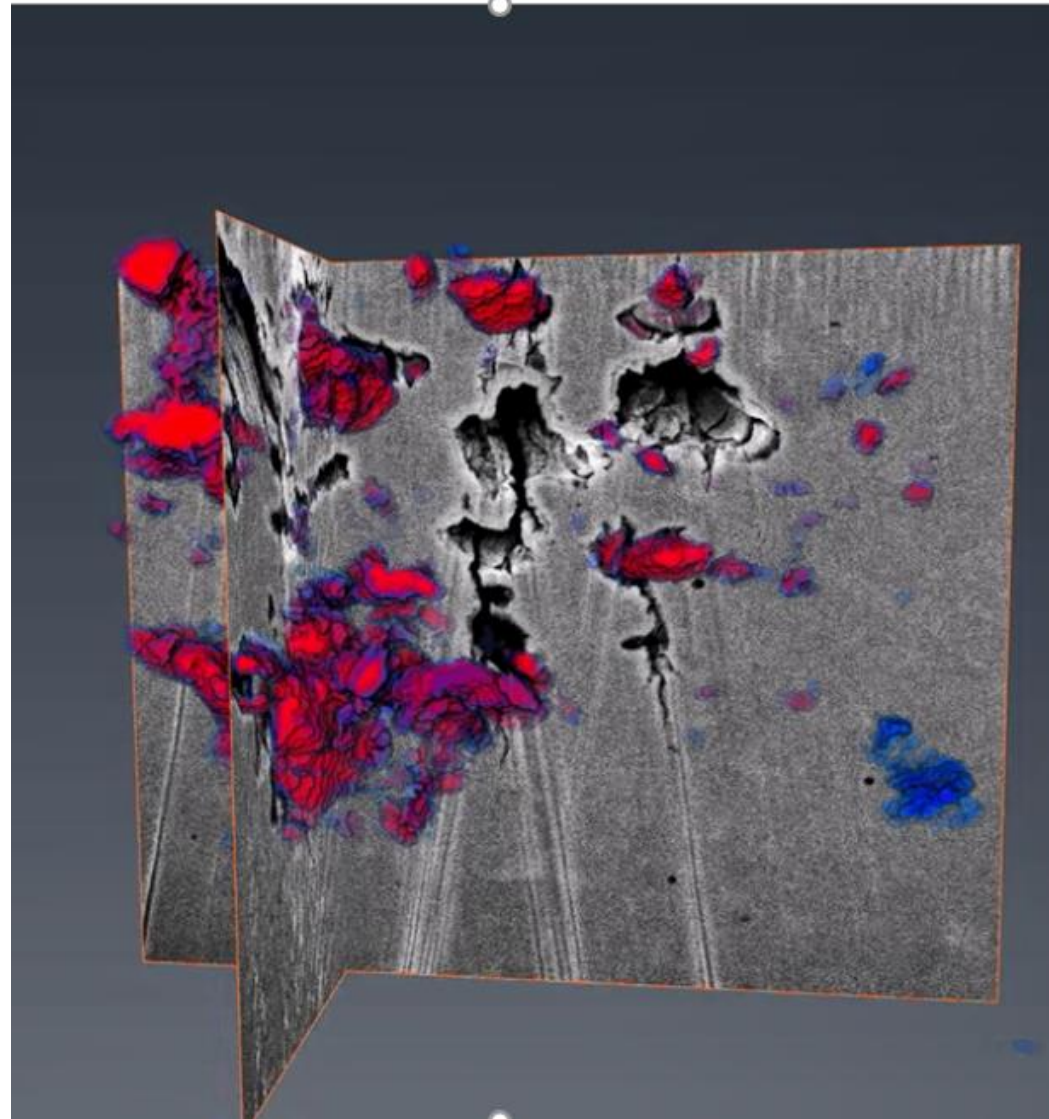
Cl



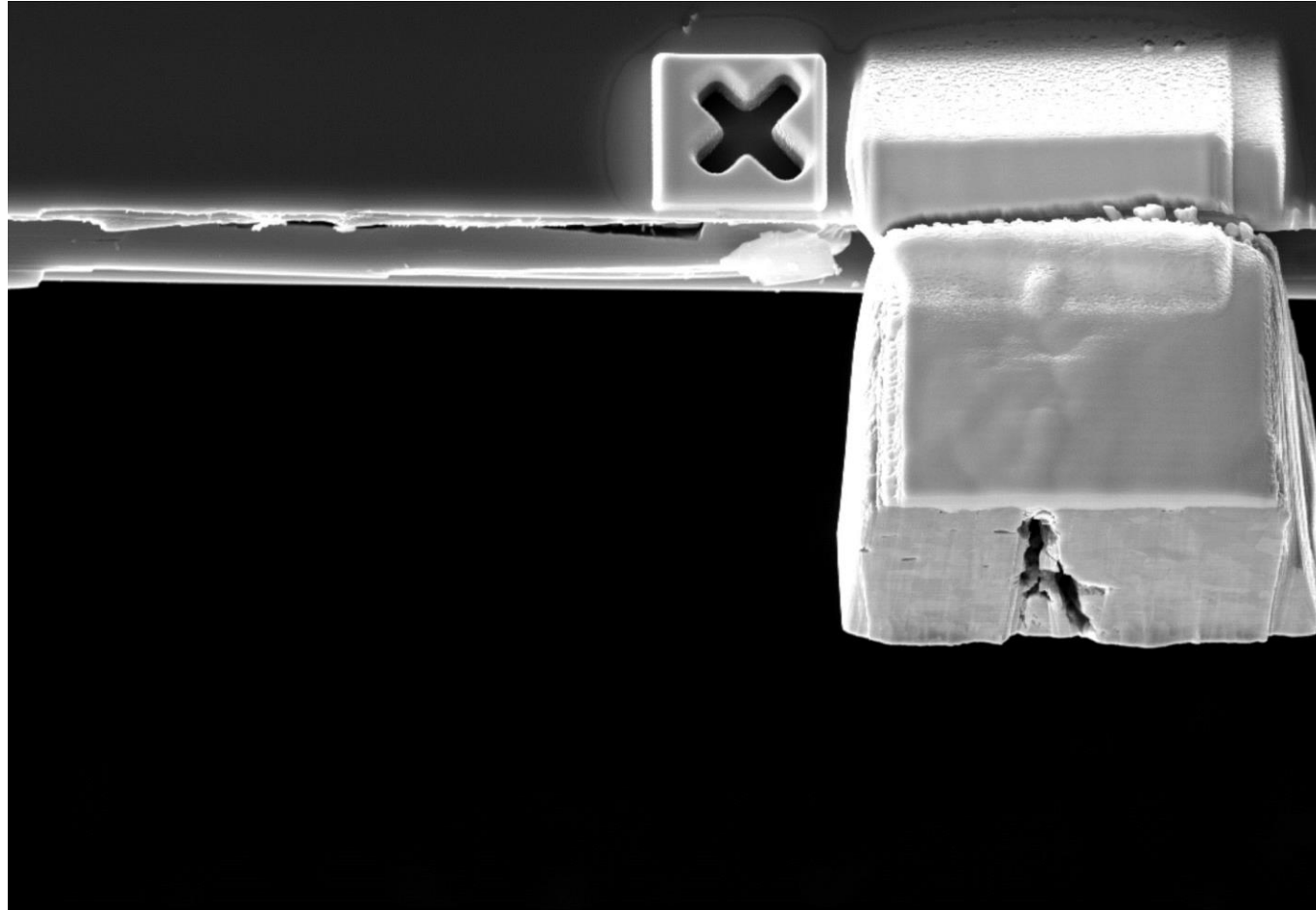
# Example of spectral image after thresholding and segmentation (used for 3D renderings)



# 3D EDS + SE image stack rendered movie

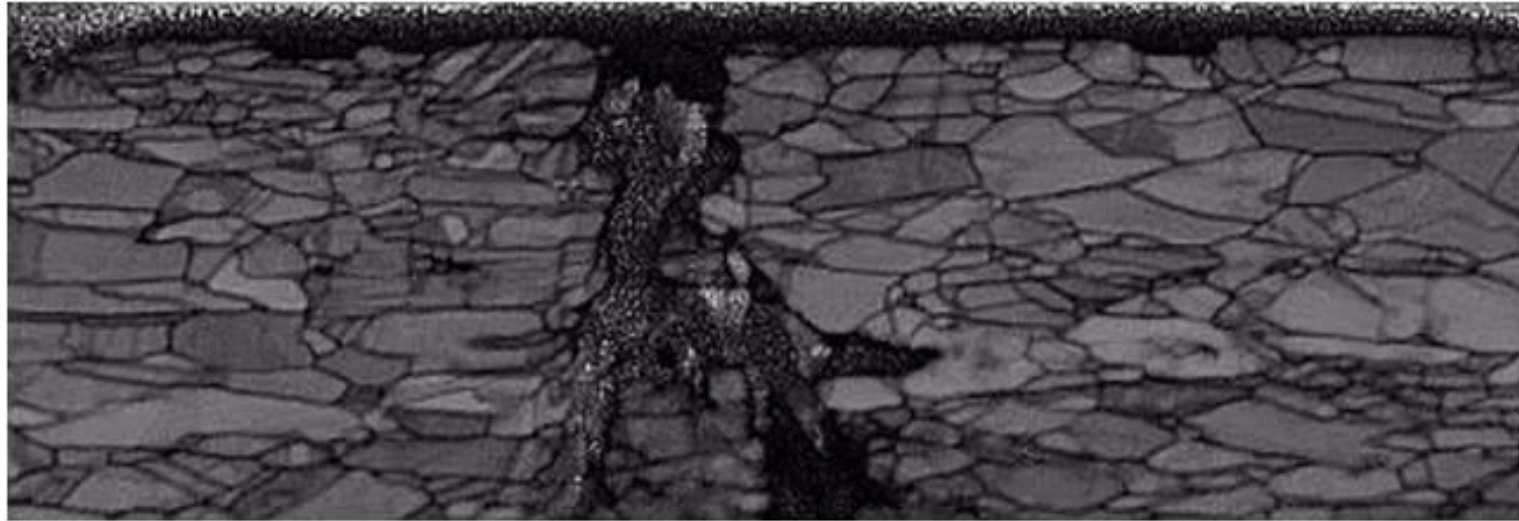


# 3D EBSD along fracture: 3013 Cl<sub>2</sub> gas

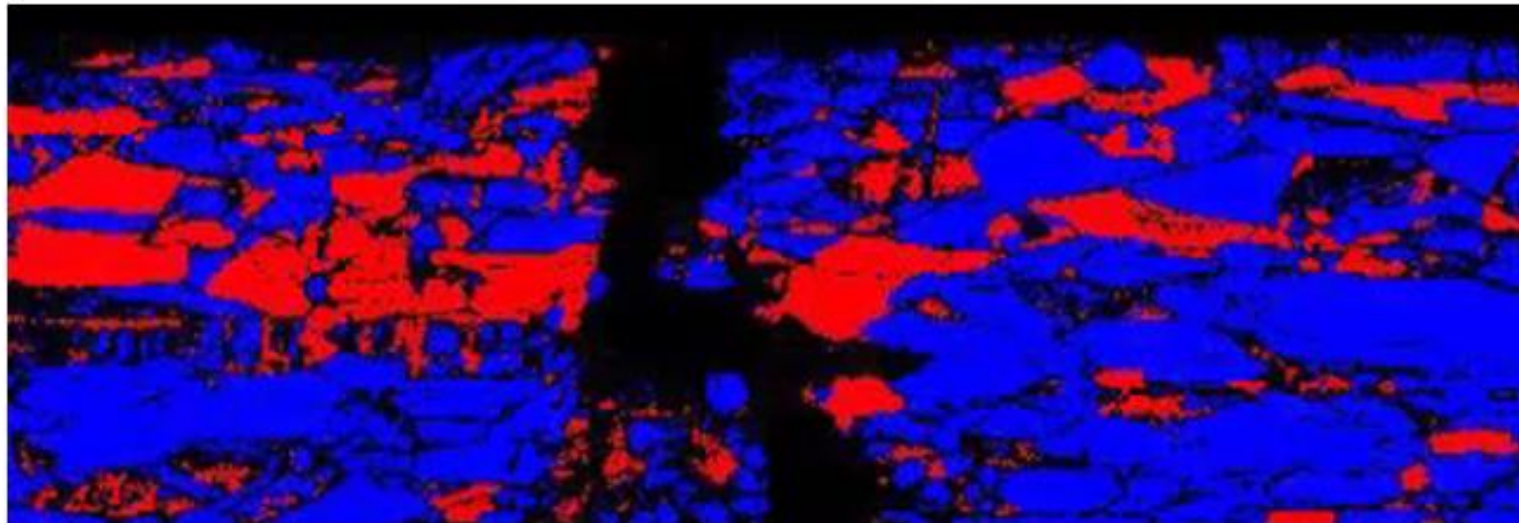


# 3D EBSD: Unprocessed band contrast and phase map movies.

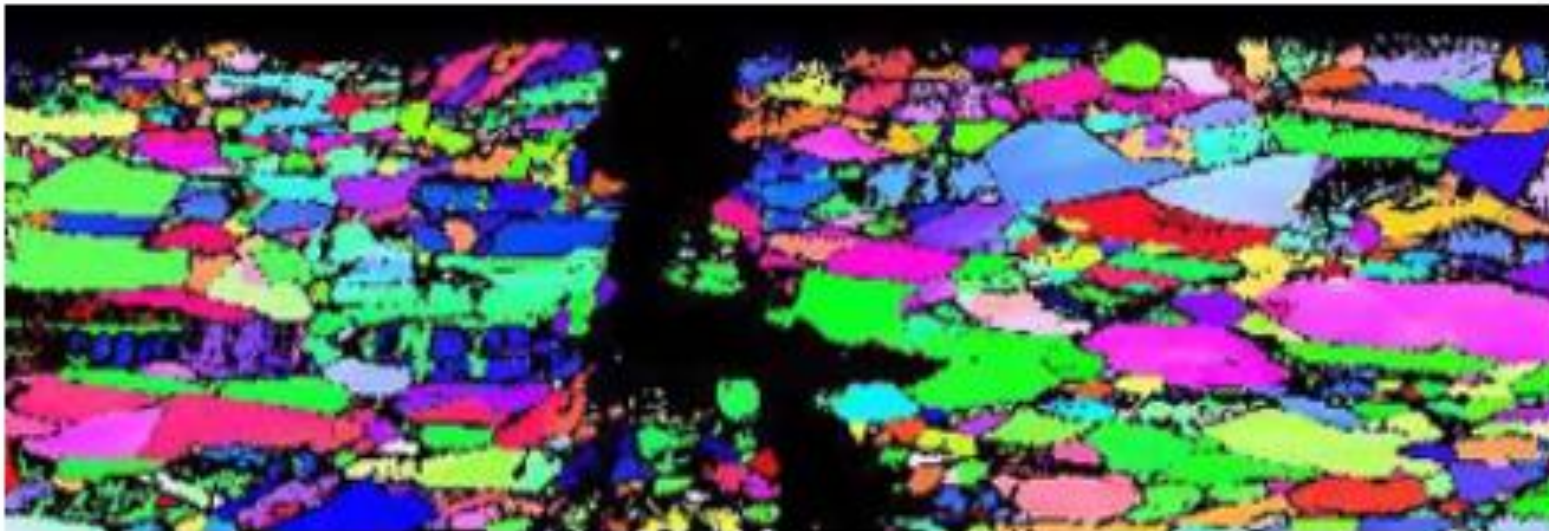
Band contrast



Phase map

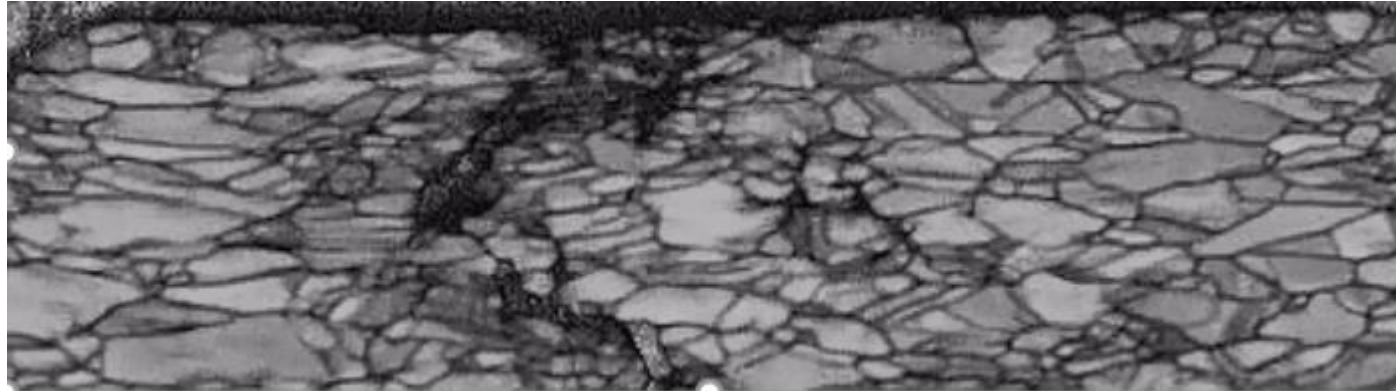


# 3D EBSD: Inverse Pole Figure Map

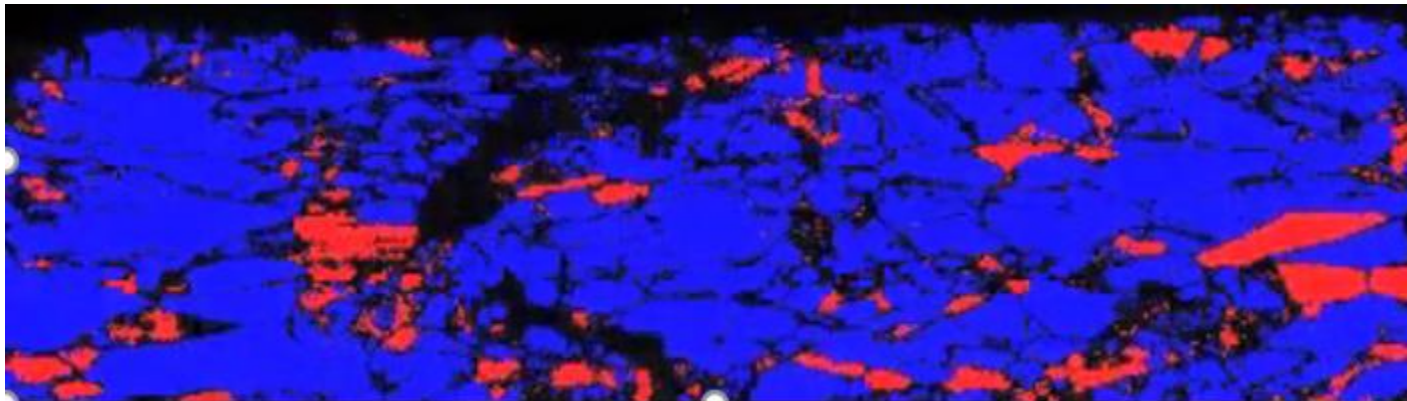


# Frame comparison

Band contrast



Phase map



Inverse Pole Figure

